REMARKS:

1) Referring to item 10) of the Office Action Summary, the Examiner is respectfully requested to accept and approve the formal drawing originally filed with this application on March 1, 2002.

2) Referring to item 12) of the Office Action Summary, and the first paragraph on page 2 of the Office Action, the Examiner's attention is directed to the certified copies of the two foreign priority applications that are being submitted together with the present Response. Acknowledgment thereof is respectfully requested.

3) A few minor informalities (typographical errors) have been corrected by the present amendment in the specification. These merely editorial corrections do not introduce any new matter. Entry of the amendment is respectfully requested.

4) The claims have been amended as follows. The format of claim 4 has been amended to more clearly recite a product or composition feature and avoid an interpretation as a product-by-process limitation. New claims 5 to 11 have been added. Claims 5 to 10 depend from claim 1, and claim 11 is an additional independent claim. The new claims are supported by the original disclosure as shown in the following table, and do not introduce any new matter. Entry and consideration of the claim amendments and the new claims are respectfully requested.

New Claims	5	6	7	8	9	10	11
Original Support	pg.7, ln.13-15; pg.9, ln.3-14	pg.5, ln.10-22	pg.5, ln.10-22	pg.3, ln.8-10; pg.5, ln.10-22; pg.8, ln.10-13	pg19, ln.1-pg.21, ln.3	pg.5, ln.10-22	Cl.1; pg.7, ln.13-15; pg.9, ln.3-14

5) Before particularly addressing the prior art rejections and comparing the claims to the prior art disclosures, the invention will first be discussed in general terms to provide a background.

The present invention is generally directed to a lithium battery, which is especially a lithium primary battery that is initially manufactured in a charged condition (see page 7, lines 13-15, and page 9, lines 3-14 of the specification), so that it does not need to be initially charged, and it is not intended to be recharged in repetitive charge-discharge cycles. This is distinguished from a lithium secondary battery that is intended to be repeatedly charged and discharged, and especially requires initial electrical charging to bring it into a charged condition after it has been manufactured.

In a lithium battery, during the electrical discharge thereof, lithium ions migrate from the negative electrode to the positive electrode within the battery in connection with the flow of electrons between the terminals outside of the battery. Thus, in a charged condition, the negative electrode contains an excess of lithium, and then during the discharge reaction lithium ions transfer from the negative electrode to the positive electrode. As a result, during the discharge, manganese dioxide of the positive electrode will be converted into lithium manganese

dioxide. For this reason, if lithium manganese dioxide is used for the positive electrode in the initial as-manufactured condition, then the discharge capacity will be reduced, because the ability of the positive electrode to accept more lithium ions will be diminished due to the lithium already contained in the lithium manganese dioxide.

Furthermore, a secondary battery that uses lithium manganese dioxide to produce the positive electrode thereof, must initially be charged electrically to drive lithium ions from the positive electrode to the negative electrode, so as to achieve a "charged" state. This is a further important distinction of the present invention, because the inventive lithium battery has a positive electrode manufactured from manganese dioxide (rather than lithium manganese dioxide) and preferably does not contain a significant amount of lithium in the as-manufactured condition of the positive electrode. Thus, the present battery is manufactured in an initially "charged" condition, and discharging of the battery can immediately proceed because the lithium ions can migrate from the lithium-based negative electrode to the essentially lithium-free positive electrode.

Another important feature of the present inventive lithium battery is that the negative electrode is made of a lithium alloy containing a precisely limited amount of 0.05 to 2 wt.% of aluminum. This critically limited content of aluminum achieves significantly improved and unexpected results, particularly relating to a reduced self-discharge rate and thus an increased storage life.

For example, the Inventive Samples C1 to C5 reported in Table 3 on page 15 of the present specification have an aluminum content in the inventive critically-limited range from 0.05 to 2 wt.%. In comparison, the Comparative Sample Z1 has no aluminum in the negative electrode, while Comparative Sample Z2 has 3 wt.% of aluminum in the negative electrode. As can be seen in Table 3, the inventive samples having the critically limited amount of aluminum in the negative electrode achieve a good self-discharge rate of 2% or less. On the other hand, the Comparative Samples Z1 and Z2 having less than or more than the claimed range of aluminum achieve a worse self-discharge rate of 2.5%. Note that the self-discharge rate of Inventive Sample C3 is less than half (i.e. more than a 50% improvement) of the self-discharge rate of Comparative Samples Z1 and Z2. Even the Inventive Samples C1 and C5 defining the critical limits of the aluminum content range still exhibit a 20% improvement over the next Comparative Samples Z1 and Z2. An improvement of 20 to 50% is a significant improvement.

Furthermore, the improvement to be achieved by limiting the aluminum content to the presently claimed critical range was unexpected and would not have been expected by a person of ordinary skill in the art. Note that the self-discharge rate does not vary in a monotonous or regular predictable manner, with respect to the varying aluminum content of the lithium alloy of the negative electrode. To the contrary, the self-discharge rate exhibits a successive improvement within the claimed range to a best-value at a 0.5 wt.% content of aluminum, and then begins to get worse again as the aluminum content varies toward the other

side of the claimed range. In other words, there is an unexpected and unpredictable "dip" in the self-discharge rate, centered at about 0.5 wt.% aluminum content, with progressively worse self-discharge rates at both higher and lower aluminum contents. There would have been no basis to predict or expect such a varying behavior of the self-discharge rate in relation to the aluminum content from the prior art disclosures.

6) Referring to pages 2 to 4 of the Office Action, the rejection of claims 1 to 3 as obvious over JP 9-270259 (JP '259) in view of US Patent 5,114,811 (Ebel et al.) is respectfully traversed.

Present independent claim 1 recites that a lithium alloy containing 0.05 to 2% by weight of aluminum is used as the negative electrode of the lithium battery. As generally discussed above, the small claimed range of aluminum content is critically limited so as to achieve unexpected and significantly improved results.

The Examiner has acknowledged that JP '259 does not explicitly teach a negative electrode as presently claimed. In this regard, the Examiner has referred to Ebel et al., which teaches a negative electrode for a lithium battery comprising a lithium-aluminum alloy that contains "from about 0% to about 50% by weight" of aluminum. It is also noted that Ebel et al. teaches that an increased content of aluminum will result in a lower energy density of the cell. Nonetheless, with such a broad and vague disclosure of "about 0% to about 50% by weight" of aluminum, a person of ordinary skill in the art would not have been motivated to provide the presently claimed critically

limited small amount of aluminum in a range from 0.05 to 2% by weight, especially in view of the unexpected and significantly improved results achieved by the invention with regard to the self-discharge rate.

The **only specific example** disclosed and enabled by Ebel et al. uses a lithium-aluminum alloy containing **15 wt.%** of aluminum for the negative electrode (col. 7, line 17). The broad, generalized disclosure of "about 0% to about 50%" of aluminum, unsupported by examples demonstrating the functionality of this broad range, is not sufficient to be an enabling disclosure, and does **not** disclose or suggest the presently claimed narrow range with **sufficient specificity** to anticipate or make-obvious the present invention. In this regard see M.P.E.P. §2131.03 and §2144.05. The vaguely disclosed range of the reference is so broad as to encompass a very large number of possible distinct compositions, without giving any particular indication toward the presently claimed narrow range. This also mitigates against a finding of obviousness (see M.P.E.P. §2144.05).

Moreover, the present application includes evidence of significantly improved and unexpected results relating to the critical limitation of the aluminum content to the small range from 0.05 to 2% by weight, as generally discussed above. Compare the Inventive Samples C1 to C5 with the Comparative Samples Z1 and Z2 reported in Table 3 on page 15 of the present specification. The inventive aluminum content achieves up to a 50% improvement in comparison to the closest composition outside of the presently claimed range. Also, the improvement of the self-discharge range does not vary in a regular predictable

manner, but rather exhibits a peak improvement at the center of the presently claimed range, with diminishing improvement in both directions of the composition toward the limits of the range. Nothing in the disclosure of Ebel et al. would have suggested or motivated the existence of such a limited range of aluminum content for achieving such improved results. The evidence of improved unexpected results can be included in the application itself (see In re Soni, 34 USPQ2d 1684 (Fed. Cir. 1995)). Such proof of significantly improved and unexpected results overcomes any prima facie case of obviousness, if such prima facie obviousness is deemed to have been established.

Regarding claim 3, the Examiner has not given patentable weight to the product-by-process limitations. However, the present specification demonstrates that the product-by-process limitations do give rise to resulting product characteristics, which are, however, difficult to define in a claim. Namely, the range of samples reported in Table 4 on page 18 of the present specification, show that a different self-discharge rate will be achieved, depending on the temperature of the heat treatment used for producing the positive electrode of the respective battery. The best improvement in the self-discharge range is achieved when carrying out the heat treatment in the temperature range recited in the product-by-process limitation of claim 3.

For the above reasons, the Examiner is respectfully requested to withdraw the rejection of claims 1 to 3 as obvious over JP '259 in view of Ebel et al.

7) Referring to pages 4 and 5 of the Office Action, the rejection of claims 1 to 4 as obvious over JP 2001-52698 (JP '698) in view of Ebel et al. is respectfully traversed.

The most important features of present independent claim 1 have been discussed above. Particularly, claim 1 recites that the lithium alloy of the negative electrode contains a critically limited amount from 0.05 to 2% by weight of aluminum for achieving significantly improved and unexpected results.

The Examiner has acknowledged that JP '698 does not explicitly teach a negative electrode as presently claimed. In this regard the Examiner turns to Ebel et al. However, as discussed above, the very broad general range of "about 0% to about 50%" of aluminum disclosed by Ebel et al. would not have enabled, anticipated, suggested, motivated, or made-obvious the presently claimed much narrower and significantly lower range. The only particular example reported by Ebel et al. includes 15% of aluminum, which is significantly different from the presently claimed critically-limited narrow range of relatively low aluminum content (0.05 to 2 wt.%). As discussed above, Ebel et al. do not disclose or suggest the presently claimed range with sufficient specificity to have made the present invention obvious. Moreover, as discussed above, the evidence of unexpected results set forth in the present application overcomes any prima facie case of obviousness that is deemed to exist.

Regarding the product-by-process limitations of claim 3, see the above discussion thereof, which pertains here as well.

For the above reasons, the Examiner is respectfully requested to withdraw the rejection of claims 1 to 4 as obvious over JP '698 in view of Ebel et al.

8) The new dependent claims 5 to 10 recite additional features that further distinguish the invention over the prior art, for example as follows.

Claim 5 expressly recites that the present battery is a lithium primary battery that is manufactured in an initially charged condition and is not intended for recharging. In direct contrast, JP '259 and JP '698 both relate to secondary batteries that must be initially electrically charged after manufacturing thereof, in order to achieve a charged condition. For example, see the last sentence of paragraph 0026 and the first sentence of paragraph 0035 of JP '698. See also paragraphs 0003, 0004, 0009, 0021, 0023, etc., as well as the English Abstract of JP '259. (The undersigned attorney believes that the symbols "***" in the computer-generated translation of JP '259 designate the words "charge" or "charging" as indicated in the English Abstract, although this has not been confirmed via an independent translation or interpretation of the reference).

Claims 6 to 10 represent various approaches of claiming the feature that the manganese dioxide of the positive electrode is not lithium manganese dioxide, as is the case in JP '259 and JP '698.

9) New independent claim 11 covers the inventive subject matter with slightly different claim terminology and format in comparison to

the original claim 1. Claim 11 further recites that the battery is manufactured in an initially charged condition and does not require electrical charging (for example see the specification at page 7, lines 13 to 15 and page 9, lines 3 to 14). This is a significant distinction in comparison to the secondary batteries disclosed by JP '259 and JP '698, which require initial charging. Furthermore, claim 11 recites the critically limited range of aluminum content in the lithium alloy of the negative electrode, which achieves unexpected improved results and supports patentability for the reasons discussed above.

10) Favorable reconsideration and allowance of the application, including all present claims 1 to 11, are respectfully requested.

Respectfully submitted,

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